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A description of four new species of fleas (Insecta, Siphonaptera) from Angola, Ethiopia, Papua New Guinea, and Peru

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Abstract

Four new species of fleas are described: *Aphropsylla truncata* **sp. n.** (Ethiopia), *Ectinorus hirsutus* **sp. n.** (Peru), *Rhinolophopsylla traubi* **sp. n.** (Angola), and *Thaumapsylla wilsoni* **sp. n.** (Papua New Guinea). Our understanding of the genus *Aphropsylla* is deficient, therefore a discussion of host/parasite relationships and new records from Uganda are provided. A key is provided for the genus *Aphropsylla*, while representatives of the other three genera are associated with existing keys to facilitate their identification. The presence of lucodiscs on *Aphropsylla* and other genera is briefly discussed. The occurrence of lucodiscs among representatives of the order Siphonaptera deserves further investigation.

Keywords

Lucodisc, fleas, Siphonaptera, new species, Angola, Ethiopia, Papua New Guinea, Peru, Uganda

Introduction

During ongoing studies of the late Robert Traub collection of fleas (maintained in the Carnegie Museum of Natural History), series containing undescribed species of *Aphropsylla* Jordan, 1932, *Ectinorus* Jordan, 1942, *Rhinolophopsylla* Oudemans, 1909, and *Thaumapsylla* Rothschild, 1907were discovered. These new taxa are herein described and additional new host and locality records are reported for the genus *Aphropsylla*.

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Materials and methods

Dissections of flea genitalia and mounting techniques were completed in accordance with procedures outlined in Hastriter (2004), and Hastriter and Whiting (2003), respectively. Methods of measuring fleas and preparing digital images follow those outlined in Hastriter and Eckerlin (2003). Line drawings were prepared with the aid of a Ken-A-Vision microprojector. Mammal nomenclature follow those of Wilson and Reeder (2005) and morphological terms are adapted from those of Rothschild and Traub (1971). Unless otherwise specified, numbers used within descriptions apply to only one side of laterally flattened microscope slide mounted specimens.

Description of four new species

Siphonaptera

Pulicidae

Aphropsylla Jordan, 1932

(Figs. 1-18)

Type species. *Aphropsylla conversus* Jordan. Novitates Zoologicae, 1932:292-293.

Aphropsylla species were originally placed in the genus *Ctenocephalus* Kolenati (now *Ctenocephalides* Stiles and Collins) until Jordan (1932) noted the generic distinction in the two genera by the position of the genal comb relative to the oral angle of the frons. Only three species of *Aphropsylla* occur in a limited region of east Africa (Ethiopia, Kenya, and Uganda).

Key to species of *Aphropsylla*

1 Males **2**

– Females (unknown for *A. wollastoni*) **4**

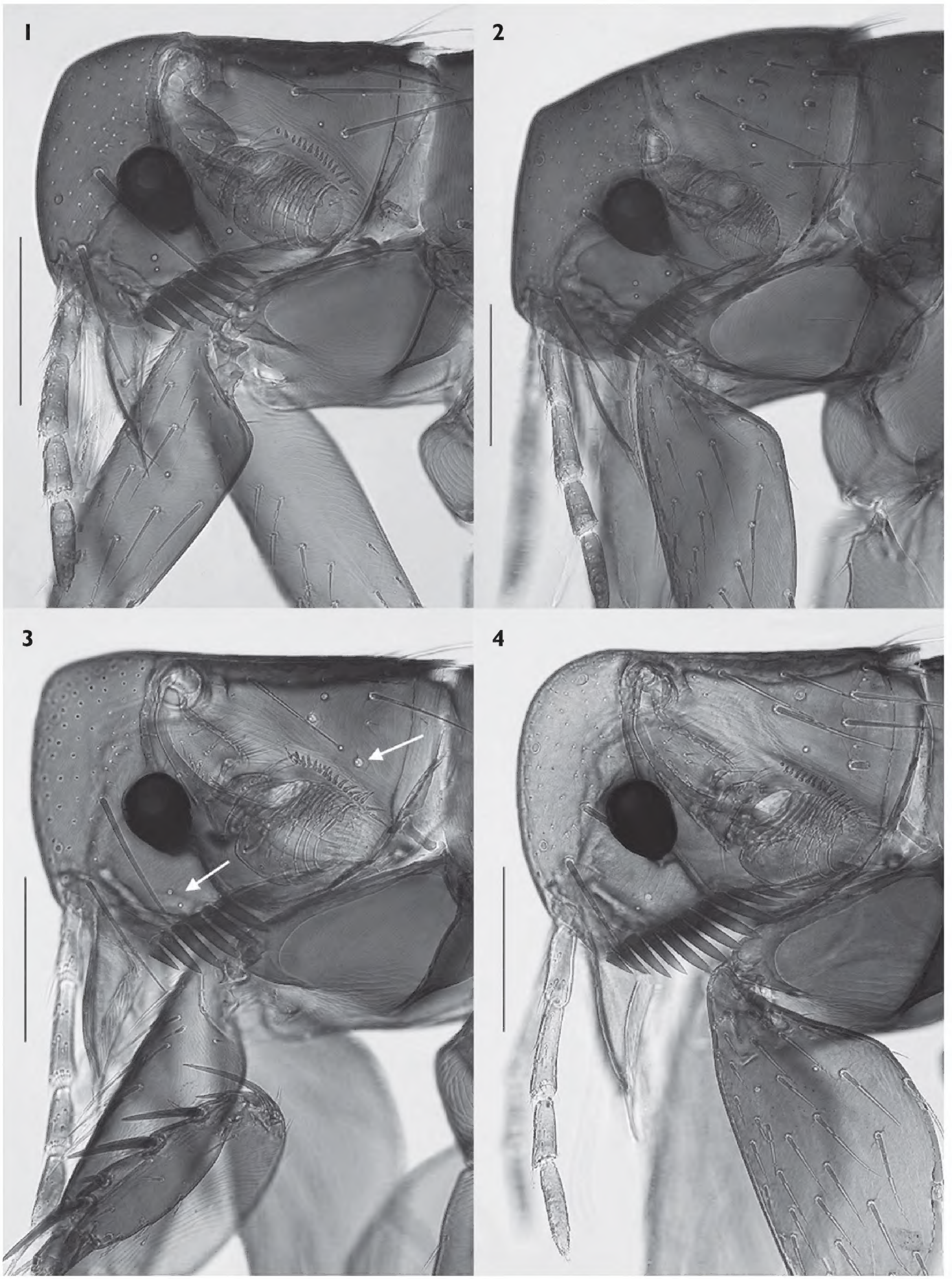
2 Apex of P1 rounded, not truncate. Length of P1 greater than 2.5 times its widest dimension (Figs. 8, 9) **3**

– Apex of P1 greatly expanded and truncate. Length of P1 less than 1.5 times its widest dimension (Fig. 7) ..... ***A. truncata*, sp. n.**

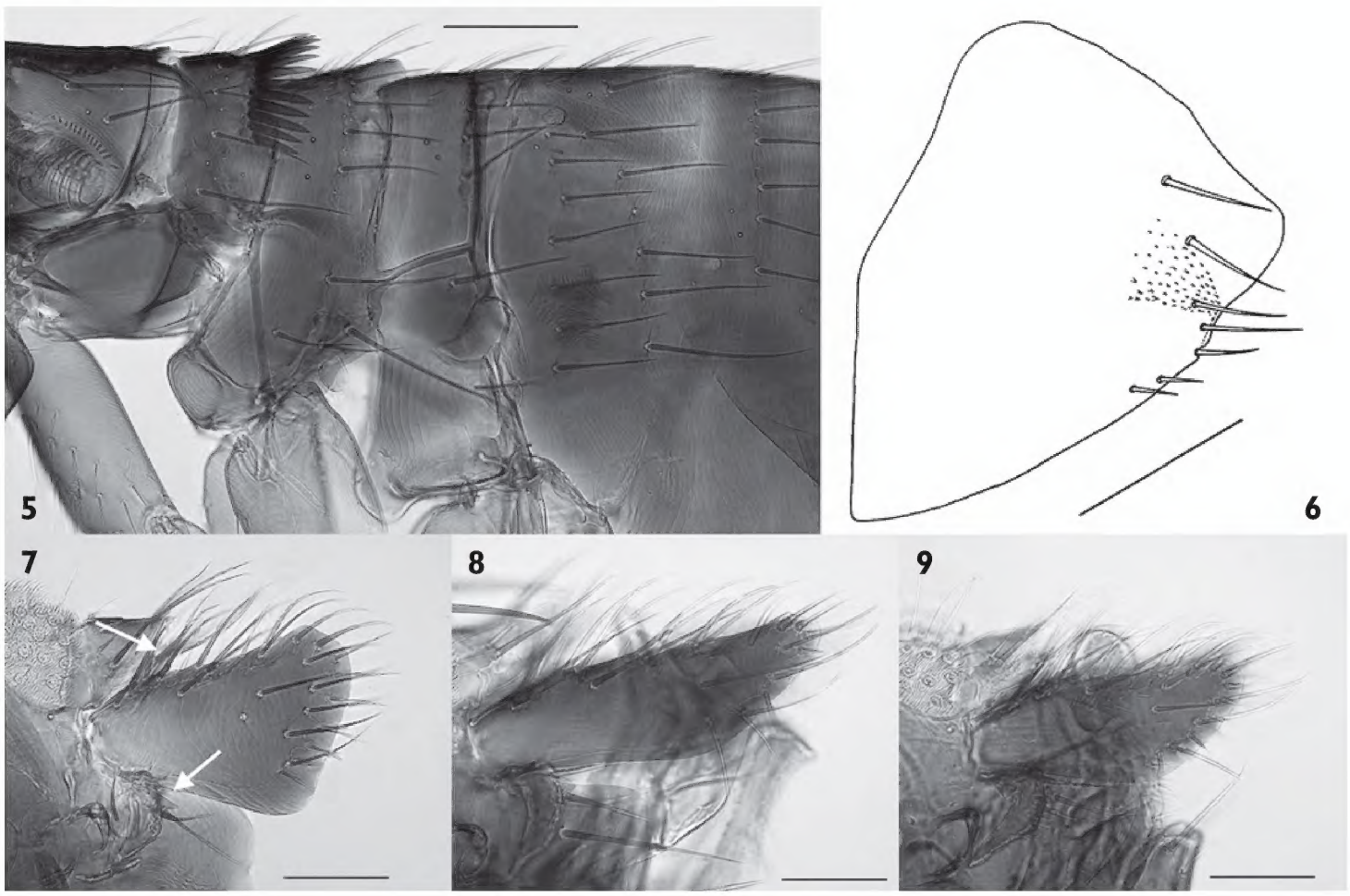
3 Genal comb usually with six or seven ctenidia (Fig. 3) ..... ***A. conversa* (Jordan & Rothschild, 1913)**

– Genal comb with 10 or 11 ctenidia (Fig. 4) ..... ***A. wollastoni* (Rothschild, 1908)**

4 First genal tooth (cephalad) nearly as long as adjacent tooth. Ventral anal lobe rounded at apex and setae restricted to apical third. Tergum eight with



Figures 1-4. 1-2. *Aphropsylla truncata* n. sp. 1. Head, holotype ♂. 2. Head, paratype ♀. 3. *Aprhopsylla conversa*, head, holotype ♂. 4. *Aphropsylla wollastoni*, head, lectotype ♂. Scale = 200 µm



Figures 5-9. 5-7. *Aprhopsylla truncata* n. sp. 5. Thorax and abdomen, paratype ♂ (B-74177). 6. Sternum eight, paratype ♂ (B-74129). 7. Process of ninth tergite (P1), paratype ♂ (B-74177), lower arrow = P2, upper arrow = P3. 8. *Aphropsylla conversa*, process of ninth tergite (P1), holotype ♂. 9. *Aphropsylla wolastoni*, process of ninth tergite (P1), lectotype ♂. Scale 5-6 = 200 µm, 7-9 = 100 µm

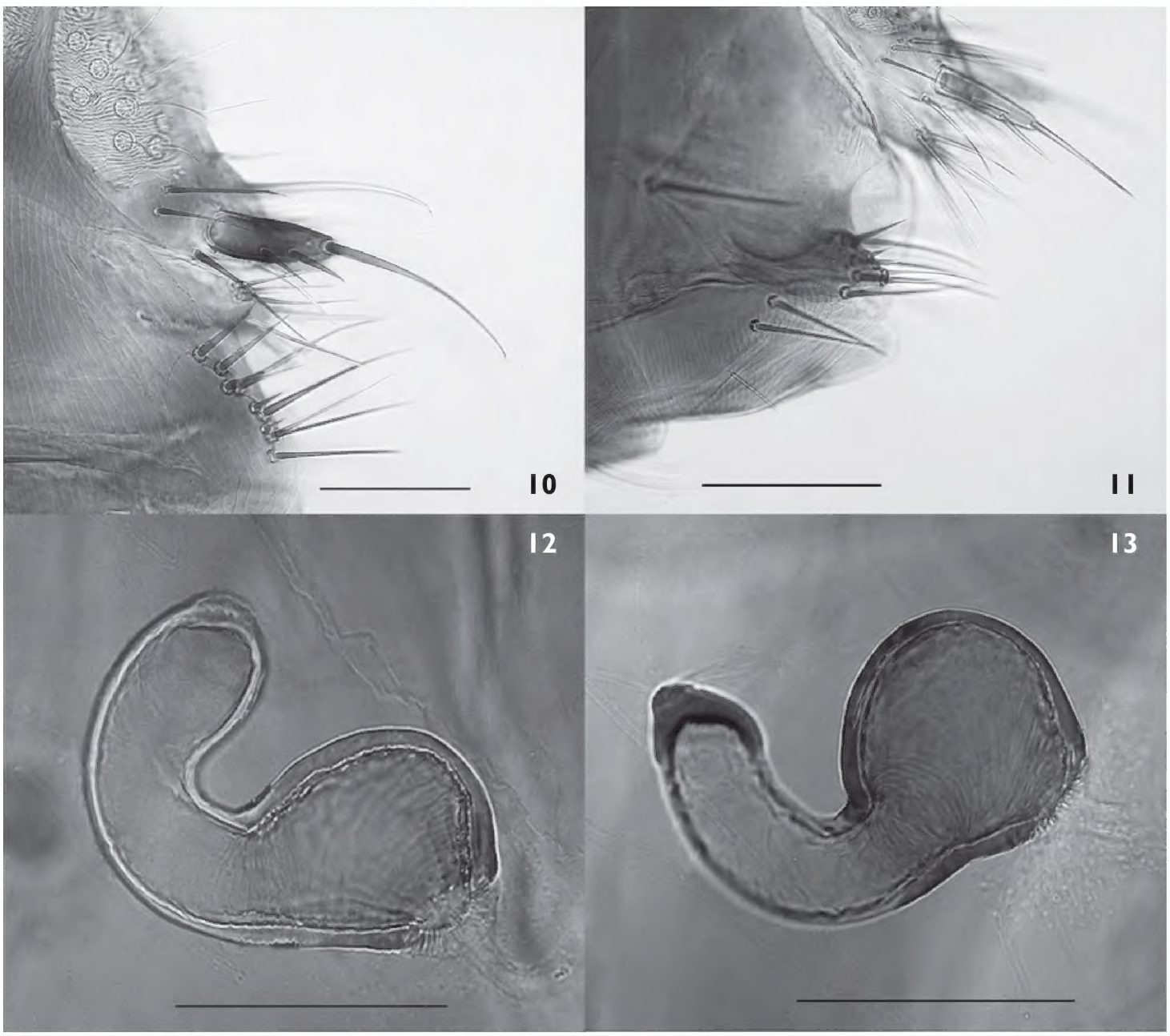
distinct sinus subtended by group of setae (Fig. 11). Second segment of labial palpus longer than proximal segment.....
.....***A. conversa* (Jordan & Rothschild, 1913)**

– First genal tooth < 1/2 the length of adjacent tooth. Ventral anal lobe oblique at apex and setae covering apical half. Tergum eight without sinus, but rounded with sinuate margin (Fig. 10). Second segment of labial palpus equal in length to proximal segment .....***A. truncata*, sp. n.**

***Aphropsylla conversa* (Jordan & Rothschild, 1913)**
(Figs. 3, 8, 11, 13, 17)

Ctenocephalus conversus Jordan & Rothschild. 1913. Novitates Zoologicae, 20:231-232.
Aphropsylla conversus Jordan. 1932:292-293; Hopkins. 1947:152.
Aphropsylla conversa Hopkins & Rothschild. 1953:133; Cheetham. 1988:35; Beaucournu. 2004:190.

Material Examined. Holotype ♂, **Kenya:** Mutaragwa, Aberdare Range, [~0°08'S, 36°07'E], ex. *Lophuromys testudo* = *Lophiomys imhausi* Milne-Edwards, 15 III 1910,



Figures 10-13. 10-11. Eighth tergite and anal stylet. 10. *Aphropsylla truncata* n. sp., allotype ♀. 11. *Aphropsylla conversa*, "neallotype" = allotype? ♀. 12-13. Spermatheca. 12. *Aphropsylla truncata* n. sp., paratype ♀. 13. *Aphropsylla conversa*, "neallotype" = allotype? ♀. Scale 10, 12-13 = 100 µm, 11 = 200 µm

Robin Kemp (BMNH); "neallotype" ♀, same data as holotype except ex. *Dendrohyrax crawshayi* = *Dendrohyrax arboreus* (A. Smith), 17 III 1910 (BMNH); paratype ♂, same data as holotype except *Genetta stuhlmanni* Mataschie = *Genetta maculata* (Gray), 23 III 1910, Robin Kemp (BMNH); 5 ♂, 4♀, **Uganda:** Bumagabula, foot of Butandiga [~1°10'N, 34°22'E], west side of Mt. Elgon, 2135 m elev., ex. "on man (acc.)", 22 II 1961, A.W.R. McCrae (BMNH).

New Records. *Uganda:* nr Bumagabula, foot of Butandiga [~1°10'N, 34°22'E], west side of Mt. Elgon, 2135 m elev., ex. "on man (acc.)", 20 II 1961, A.W.R. McCrae (British Museum Reg. No. 1961-684), 5 ♂, 4♀ (BMNH).

Remarks. When Jordan and Rothschild described this species, they erroneously labeled one female (same data as holotype) as a "neallotype". It is presumed they ment "allotype" and not "neallotype" or neoallotype. Host preferences for this species of *Aphropsylla* are virtually unknown since only a single specimen had been collected from each of the three known host species (other than man). *Genetta maculata*, a small agile

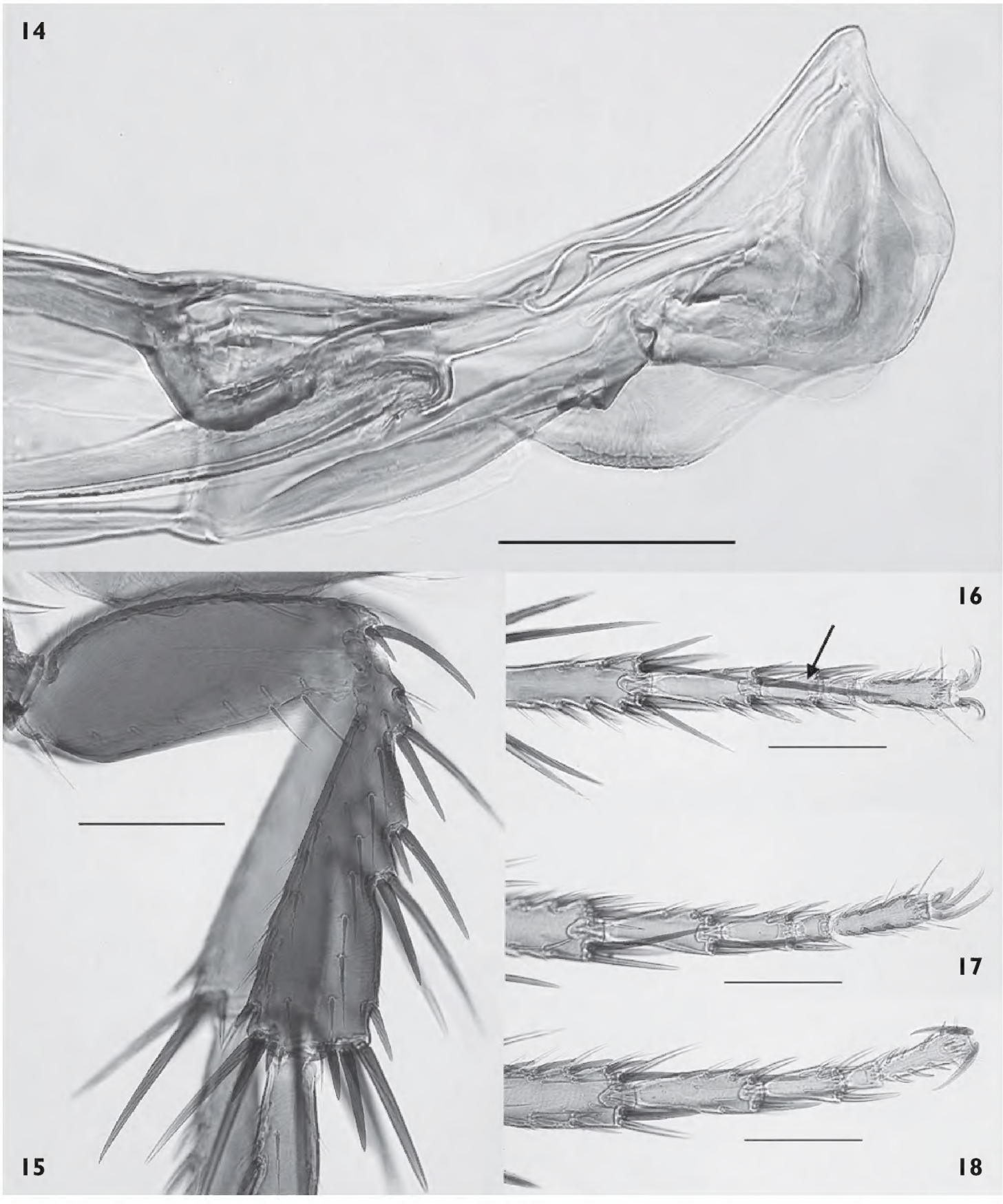


Figure 14-18. 14-16. *Aphropsylla truncata* n. sp. 14. Aedeagus, paratype ♂ (B-74177). 15. Hind femur and tibia, allotype ♀. 16. Hind tarsi, holotype ♂. 17. *Aphropsylla conversa*, hind tarsi, holotype ♂. 18. *Aphropsylla wollastoni*, hind tarsi, lectotype ♂. Scale 14 = 100 µm, 15-18 = 200 µm

and scansorial carnivore, is certainly an accidental host, likely infested with one specimen correlated with the host's carnivorous habits. *Lophiomys imhausi* and *D. arboreus* are both herbivores. Although the latter is arboreal, the single specimen recorded from it is also likely accidental. The label data for the nine specimens reported here, all indicate that the host was "on man" and it is presumed that the collector (or labeler)

assumed man was an "acc. = ?accidental" host. Unfortunately, the circumstances are not known surrounding the collection of no less than nine specimens from a human. There was surely some intimate contact with a bird or mammal nest by the "human host". The fact that a sizable series of the new species described below was collected from bird nests (and not from a mammal per se) might suggest that the genus has close evolutionary affinities to avian hosts.

***Aphropsylla truncata* Hastriter, sp. n.**
urn:lsid:zoobank.org:act:54E661D4-54F6-49BD-BA8B-17E217DBB94C
(Figs.1, 5-7, 10, 12, 14-16)

Type Material. Holotype, ♂; allotype ♀, and11 ♂, 10♀ paratypes, **Ethiopia:** Bale Province, Bale Mts., Bale National Park, Dinshu (sic) Dinsho [~6°46'N, 39°40'E], 3018 m elev., ex. "bird nest, nest four feet from ground", 22 II 1973, R. Traub and J. Ash (12 slides B-74177: 12 ♂, 9♀, 2 slides B-74176: 2♀); 8 ♂ , 8♀ paratypes, same data as holotype except ex. "mossy bird nest in tree", 19 II 1973 (8 slides B-74129); 1 ♂, 1♀ paratypes same data as holotype except ex. "mouse nest on bird nest in bush", 20 II 1973 (1 slide B-74150); 1♀ paratype, same data as holotype except ex. "*Dendromus* [Smith, 1829] nest, nest ~5 feet from ground", 21 II 1973 (slide B-74173); and 1♀ paratype, same data as holotype except ex. "*Dendromus* nest atop bird nest on bush, nest ~5 feet from ground", 21 II 1973 (slide B-74174). Primary types and all paratypes except for 6 paratypes (3 slides B-74177) in the author's collection are deposited in the Carnegie Museum of Natural History, Pittsburgh, PA.

Diagnosis. Male easily distinguished from *A. conversa* and *A. wollastoni* by the short truncate shape of P1 (length <1.5 greatest width vs. length >2.5 x greatest width), the presence of a spiculated intersegmental membrane between the lobes of S-VIII, and one seta of fourth hind tarsal segment extended beyond base of distotarsomere 3. Female sex of *A. wollastoni* unknown. Female sex of *A. truncata* separable from *A. conversa* by 1) ventral anal lobe broader, ventrally oblique at apex, and adorned with setae on distal half, 2) anal stylet 3 x as long as greatest width vs. >4 x as long as width in *A. conversa,* 3) T-VIII without deep marginal sinus as *A. convera*, 4) first genal tooth <half length of adjacent tooth, nearly as long as adjacent tooth in *A. conversa*, 5) 7-8 genal teeth vs. 8-9 in *A. conversa*, and 6) one seta of fourth hind tarsal segment extending beyond base of distotarsomere 3.

Description. Head (cf. Figs. 1-4). Anterior frons vertical, abrupt obtuse angle caudad to antennal groove (female more angular). Numerous minute coniform pegs on anterior preantennal area. Two large ocular setae; patches of four minute setae below and 10 setae above dorsal ocular seta. Gena with 6-7 sharp darkly pigmented ctenidia (female = 7-8). Small lightly pigmented sharp spine ventrad to apex of genal lobe. Three placoids evenly distributed along margin of frons, single placoid near occipital groove (female same except with two placoids along dorsal occipital area and single placoid laterally). Lucodiscs (appear pearly as tiny shiny air bubbles) occur 1)

two between eye and genal ctenidia, 2) one anterior to genal spine, 3) one dorsad of clavus, 4) two laterally on each thoracic segment and each abdominal T-I-VII and S- II-VIII (female without lucodisc on S-VIII). Eye large, oval, darkly pigmented. Antennal segments stubby and broad. Scape with numerous slender setae; pedicel with marginal long setae extending to 3/4 length of clavus. Ventral clavus of male with first seven segments fused (all fused in female). Genal lobe produced upward to enclose most of antenna within fossa. Postantennal area with three rows (1, 1, and 4) setae (female = 1, 3, and 6). Occipital groove with dense cluster of minute setae within darkly pigmented groove. Penultimate segment of labial palpus shortest; second segment longest. Maxillary lobe stout, acutely pointed; lobes of five segments, extended 1/2-3/4 length of fore coxa. **Thorax** (Fig. 5). Each segment with erect dorsal mane; pronounced on pronotum. Pronotum with single row five setae with intercalaries. Pronotal ctenidia of 12-13 in male (female = 15-16). Base of pronotal ctenidia with peduncle and pit-like incrassations. Meso- and metanota each with row of five marginal setae with intercalaries; mesonotum with dorsal anterior patch of ~30 minute scattered setae, metanotum with anterior row of two setae. Prosternosome stout; without lateral depression; first link plate bar-like without prosternosomal notch. Second link plate robust, spiracle small. Mesepimeron with single dorsal seta; three ventral setae. Mesepisternum without setae; mesosternum quadrate, extended down. Pleural rod bifurcate dorsally. Mesothoracic spiracle mesal and borne in cup-like stalk. Lateral metanotal area and metepisternum fused, with partial sulcus only; single seta in each area. Metasternum quadrate and jutting downward. Pleural ridge and furca fused and stout; pleural arch unusually thick and massive. Metepimeron with two vertical rows (6-7 anterior, 7-8 posterior); spiracle round and dorsad to dorsal most setae. **Legs** (Figs. 15, 16). Procoxa with 28-30 lateral setae (excluding marginals). Lateral sulcus of mesocoxa interrupted. Metacoxa with mesal group of 18-20 short spiniform setae. Profemur with five small lateral setae; one small mesal seta. Femoral-tibial guard setae two on all segments; lateral shortest or thinner of two. Margin of fore, mid and hind tibiae with 5, 6, 6 dorsal notches, respectively. Number of setae in respective dorsal notches: fore tibia (beginning with proximal notch) (1, 2, 2, 2, 2), mid tibia (1, 2, 2, 2, 2, 3), hind tibia (2, 2, 2, 2, 1, 4). Lateral setae of meso- and metatibia, respectively (5, 13). Apical seta of hind tarsomere II extended well onto distotarsomere. Distotarsomeres each with 4 pairs lateral plantar bristles, 2 spiniform preapical plantar bristles; in addition to usual preapical lateral hairs. Numerous fine setae on plantar surfaces of distotarsomeres. **Unmodified Abdominal Segments** (Fig. 5). T-I with three rows of setae; T-II-VII each with single row of setae with intercalaries. Lowest setae level with round spiracles. Four minute setae on keel of S-II. One lateral seta on S-III-VII (female with one seta on S-II-VI and two on S-VII). Three antesensilial bristles; mesal and lateral vestigial. Sensilium with 14 sensilial pits. **Modified Abdominal Segments, Male** (Figs. 6, 7). Tergum VIII reduced; without setae. Tergum IX with P1 narrow at base, expanded and truncate at apex. P2 ventrolateral to P1, lobate with 6-7 caudally directed setae of which one is long. Cylindrical trichoid sensilium with two apical setae. Sternum VIII with seven lateral setae; dorsal lobe subtended by shallow sinus.

Distal arm of S-IX broader at base than apex; apex hooked caudad. Caudal margin fringed with numerous fine setae, lacking apodemal rod. Spiculated intersegmental membrane connecting mesal area of S-VIII. **Aedeagus** (Fig. 14). Aedeagal apodeme long and narrow. Penis rods exceed apex of aedeagal apodeme. Ventral lateral lobe expanded ventrad. Median dorsal lobe hood-like at dorsoapical margin. Sclerotized inner tube with dorsal spine on basal third; confined within phallosome. Crochet large and bilobed; ensheathed within lateral lobe. **Modified Abdominal Segments, Female** (Figs. 10, 12). Tergum VIII with four lateral setae and two marginal setae on broad lobe; several short spiniform mesal setae. Sternum VIII angled apically; with longitudinal striations, no setae. Dorsal anal lobe triangular; anal stylet robust with two lateral short setae and long apical seta. Ventral anal lobe broad with ventrally oblique apex; setae numerous on apical half. *Fibula vaginalis* sclerotized. Cribriform area of spermatheca at ventroapical aspect of bulga. Bulga spherical. Bulga and hilla subequal in length; no demarcation between them.

Length (slide mounted specimens): Holotype 2.4mm, male average: 2.4mm (n = 13; range: 2330-2641 µm); allotype 2.3mm, female average: 2.4mm (n = 14; range: 1986-2806 µm).

Etymology. The species name "*truncata*" is derived from *truncus* (L.) or "cut off", which is descriptive of the male eighth tergite (P1) unique to this species of *Aphropsylla*.

Remarks. All specimens were collected in an arboreal situation from a nest. Nests were either individual bird nests, or a *Dendromus* nest associated with a bird nest. It is significant that 39 specimens from three different collections were collected from a bird nest unassociated with a mammal nest, while only two collections yielding only 3 specimens were collected from *Dendromus* nests associated with the same type of "mossy" bird nests. It would appear that this species is biologically associated with a bird and that the mammal is an accidental host species. It is unfortunate that the bird species is unknown; however, judging from the nest materials, height of nests, elevation, and endemic locality of Dinsho, likely candidates might be the Black Headed Sisken (*Serinus nigriceps* Ruppell) or other local species of the genus *Serinus* Koch. These bird species should be investigated as possible avian host species.

The genus *Aphropsylla* (Archaeopsyllini Oudemans) has several unique features shared by few other genera. A dense array of fine setae lining the recess of the occipital groove is present in males. In other flea taxa, this area is usually devoid of setae, or is limited to sparse or unapparent setae. Another unusual feature is the presence of lucodiscs, a term coined by Traub and Johnson (1952) and first identified in the distant related genus *Stenoponia* Jordan & Rothschild. Within the tribe Archaeopsyllini, lucodiscs also occur in the genera *Archaeopsylla* Dampf and *Ctenocephalides* Stiles & Collins. The author was unable to examine the other two rare genera in this tribe (*Centetipsylla* Jordan and *Nesolagobius* Jordan & Rothschild) to determine the presence of lucodiscs. All three genera in the tribe Hystrichopsyllini Tiraboschi (*Atyphloceras* Jordan & Rothschild, *Hystrichopsylla* Taschenberg, and *Typhloceras* Wagner) also have lucodiscs. It should be noted that lucodiscs are distinct morphological entities present in defined patterns, which are species specific. They

may have significance in identification criteria and phylogenetic relationships. Lucodiscs are not the subject of this paper; however, their prevalence among the order Siphonaptera deserves further investigation beyond this discussion.

Aphropsylla wollastoni Rothschild
(Figs. 4, 9, 18)

Ctenocephalus wollastoni Rothschild. 1908. Entomologist's Monthly Magazine, 44:76-79.
Aphropsylla wollastoni Jordan. 1932:292-293; Hopkins. 1947:152; Hopkins and Rothschild. 1953:133; Cheetham. 1988: 102; Beaucournu. 2004:190.

Material Examined. Lectotype and paralectotype ♂♂, **Uganda:** Mubuku Valley [~0°21'N, 30°02'E], E. side of Rwenzori [Range], 1830 m elev., ex. "a mouse", 10 III 1906, A.F.R. Wollaston (BMNH).

Remarks. Rothschild (1908) described *A. wollastoni* from three males from the Rwenzori, Uganda. The female is not described and additional records, other than the type series, have never been reported. The host of this flea remains to be determined. Future collections might well be directed from bird nests of finches (family Fringillidae) at or near the type locality.

Ischnopsyllidae

Ischnopsyllinae

Rhinolophopsylla traubi Hastriter, sp. n.
urn:lsid:zoobank.org:act:CAF9F887-9E01-41F0-A261-7C74640BD48A
(Fig. 19-25)

Type Material. Holotype, ♂ and 4♂, 5♀paratypes, **Angola:** Huila Province, Fãn and Huila [15°13'59.988"S, 13°31'0.0114"E], ex. *Rhinolophus eloquens* K. Andersen, 4 XII 1954, Gerd Heinrich (6 slides B-46465, B-46468, B-46469); allotype ♀ and 3♂, 3♀ paratypes, same data as holotype except XI-XII 1954 (4 slides B-46466); and 1♂ paratype, same data as holotype except ex. *Miniopterus* sp. (slide B-46472). Holotype, allotype and all paratypes deposited in the Carnegie Museum of Natural History, Pittsburgh, PA (CMNH) except for three paratypes (2 slides, B-46465, B-46472) in the author's collection.

Diagnosis. Males and females differ from *R. ashworthi* (Waterston) by the absence of combs on the metanotum and first two abdominal segments. Most closely allied to the *R. unipectinata* ssp. complex but can be distinguished from those in the male by details of the aedeagus (lacking expanded median dorsal lobe), S-VIII, and the marginal position of the acetabulum with telomere extended beyond posterior margin

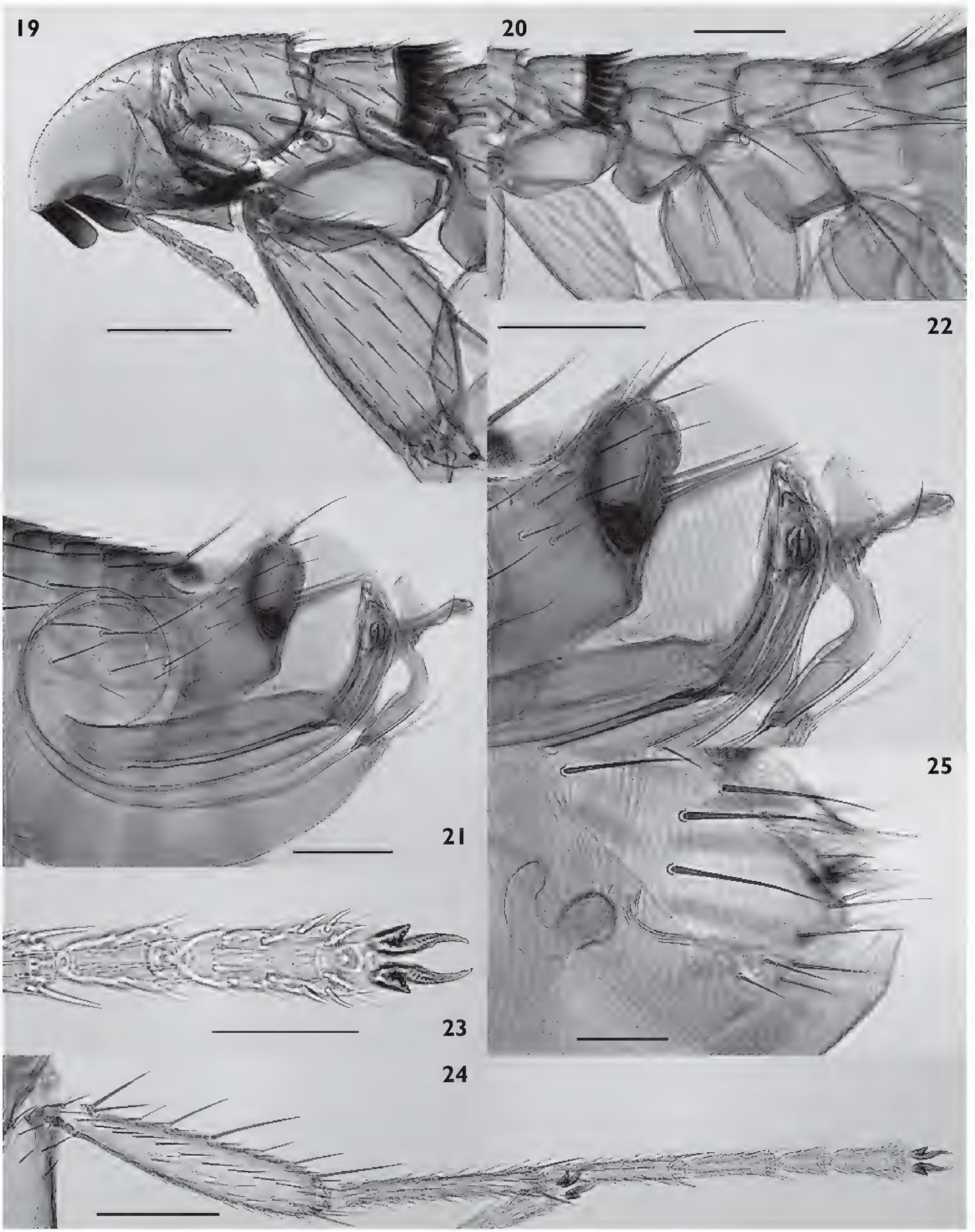


Figure 19-25. *Rhinolophopsylla traubi* n. sp. 19. Head and pronotum, paratype ♀ (B-46466). 20. Thorax, holotype ♂. 21. Abdomen and terminal segments, holotype ♂. 22. Eight and ninth tergites, aedeagus, and ninth sternite, holotype ♂. 23. Distotarsome 3, paratype ♂ (B-46466). 24. Hind tibia and tarsi, paratype ♂ (B-46466). 25. Spermatheca, bursa copulatrix, and terminal segments, paratype ♀ (B-46466). Scale 19-22 and 24 = 200 µm, 23 and 25 = 100 µm

of caudal portion of basimere. Females of all species are similar, but *R. traubi* females may be separated from *R. ectopa* (Jordan) and *R. capensis* Jordan & Rothschild by the presence of a group of 4-5 setae anterior to the usual marginal group of setae on T-VIII and from *R. unipectinata* ssp. by group of 3-4 spiniform setae at upper posterior mesal margin of T-VIII. Both males and females key out as *R. capensis* in key of Hopkins and Rothschild (1956:347).

Description. Head (Fig. 19). Preoral genal spines spatulate, darkly pigmented; posterior spine expanded towards apex. Pale band along smooth margin of frons with one slender seta at oral angle, 14 minute setae separating pale band from preantennal area, and seven slender setae continuing dorsad. Preantennal area adorned with numerous minute scattered setae; ten to twelve setae along ventral margin of antennal fossa, large ocular setae anterior to vestigial, ventrally notched eye, extended beyond genal process. Gena heavily sclerotized, dark at apex; latter sinuate and truncate. Apical half of scape with 7-8 scattered thin setae. Pedicel with 4-5 slender setae extended one third length of clavus. Clavus extended to no further than apex of gena. Three long setulae along dorsal margin of antennal fossa. Postantennal area with numerous scattered setae. Maxilla truncate; labial palpus with six segments. Well developed preoral tuber present. **Thorax** (Figs. 19, 20). Pronotal ctenidia of 20 spines; three rows of setae (1-3, 4, 5). Prosternosome expanded dorsad; large notch with first link plate. Meso- and metanota with numerous setae; main row on metanotum exceptionally long. Metanotum with two marginal spinelets. Mesepisternum with two setae; mesepimeron with two dorsal and three ventral setae. Pleural rod slender; upper portion entirely spread cephalad. Mesosternum heavily sclerotized on ventral half. Lateral metanotal area with one large seta. Metepisternum with one equally large seta. Pleural ridge without pleural arch. Metepimeron with two vertical rows, each with two setae, all below round spiracle. **Legs** (Fig. 24). Fore coxa with 30 lateral setae excluding marginal setae. Meso- and metacoxae with setae along anterior margins. Large seta at apex of metacoxa set in extra large alveolus; apicocaudal notch shallow. Profemur with 6-7 lateral setae; meso- and metafemora each with 4-5 lateral apical setae. Coarse oblique, parallel reticulations on lateral aspect of femora; mesal surface reticulated sculpturing perpendicular to femora. Femorotibial joints with two guard setae each; lateral smaller of pairs. Sparse false comb on dorsal margin protibia and mesotibia; metatibia slender with single long seta in poorly defined dorsotibial notches, most with small basal seta. First and second mesotarsal segments subequal in length. First metatarsal segment long, but less than segments 2-4 combined. Five lateral plantar bristles; first pair shifted onto plantar surface between second pair. Two preapical plantar bristles; two preapical plantar hairs. Dorsal surface of distotarsomere III with longitudinal row of five fine setae; two apical fine setae resembling preapical lateral hairs. **Unmodified Abdominal Segments, Male** (Fig. 21). Apical spinelets on T-I-III (3, 1, 1). Tergites heavily sclerotized dorsally. Five to six setae in each row; lowest seta at or just below level of round spiracles. Tergum VIII dorsoapically expanded; enveloping T-IX with 7-8 lateral setae dorsally. Apical margin T-VIII minutely serrate. Sternites II-IV with single seta; S-V-VII each with two setae. Small setae lateral and mesal to long antesen-

silial bristle. Sensilial plate expanded caudally; 20 pits in sensilium. Female similar to male except dorsal margins of tergites less sclerotized; single spinelet on T-4. Female S-II-III with single seta, S-IV-VI with three setae. **Modified Abdominal Segments, Male** (Figs. 21, 22). Basomere caudally rounded; acetabular bristles three [two on one side in holotype, three on other side (three the norm)]; acetabulum nearly marginal with telomere extending well beyond caudal margin of basimere. Basimere with long apical seta; two lateral setae. Manubrium with hook-like sclerotization in middle of plate. Sternum VIII with teat-like apex adorned with two long setae, 3-4 smaller basal setae. Proximal arm of S-IX lacking; distal arm with quadrate apical lobe adorned with four small marginal setae, one long curved seta. Apodemal rod long, extending well beyond apex of penis plate. **Aedeagus** (Fig. 22). Aedeagal apodeme with parallel margins. Penis rods forming 3/4 revolution. Ventral lateral lobes divided by shallow sinus. Median dorsal lobe inconspicuous and rounded apically. Crochet dominant feature of aedeagus; hyaline proximal lobe reduced. Paxillus long, peg-like, associated with subtending sinus of apical lobe of distal arm S-IX. Sclerotized inner tube with thumb-like sclerotization on dorsal aspect. **Modified Abdominal Segments, Female** (Fig. 25). Caudal margin T-VIII sinuate; with three long dorsal setae, group of four slender setae anterior to marginal setae. Marginal setae include 4-5 long setae; group of 3-4 mesal spiniform setae. Sternum VII with row of five lateral setae; small broad dorsal lobe subtended by shallow sinus extended to ventral margin. Sternum VIII boat-shaped, without setae; ventral margin moderately sclerotized. Dorsal anal lobe with setae on dorsoapical half; anal stylet twice length of maximum width with long apical seta, two basal setae. Ventral anal lobe acutely pointed; setae on ventroapical half. Bulga spherical; hilla twice length of bulga; subapical entrance of duct of spermatheca. Bursa copulatrix sclerotized to perula; perula with distal sclerotization.

Length (slide mounted specimens): Holotype 2.1mm, male average: 2.2mm (n = 9; range: 1885-2371 µm); allotype 2.4mm, female average: 2.3mm (n = 9; range: 2130-2558 µm).

Etymology. To Robert Traub, this flea is named *Rhinolophopsylla traubi* in his honor and his memory. Even after his death, Robert Traub's genius in work on ectoparasites (especially fleas and mites) continues to inspire those who marvel at his keen insights on zoogeography and evolution of these groups.

Thaumapsyllinae

Thaumapsylla wilsoni Hastriter, sp. n.

urn:lsid:zoobank.org:act:12DCADE9-21EA-4692-9F1D-1464C7838E88
(Figs. 26-31)

Type Material. Holotype, ♂ and 2♂ paratypes, **Papua New Guinea:** [Golf Province], Kukuba caves [lowlands], ex. *Dobsonia moluccensis* (Quoy and Gaimaard), 1 IX 1972, R.L. Vanderwal (3 slides B-87002); 4♂ paratypes, Javavare caves, 73 km NE Port

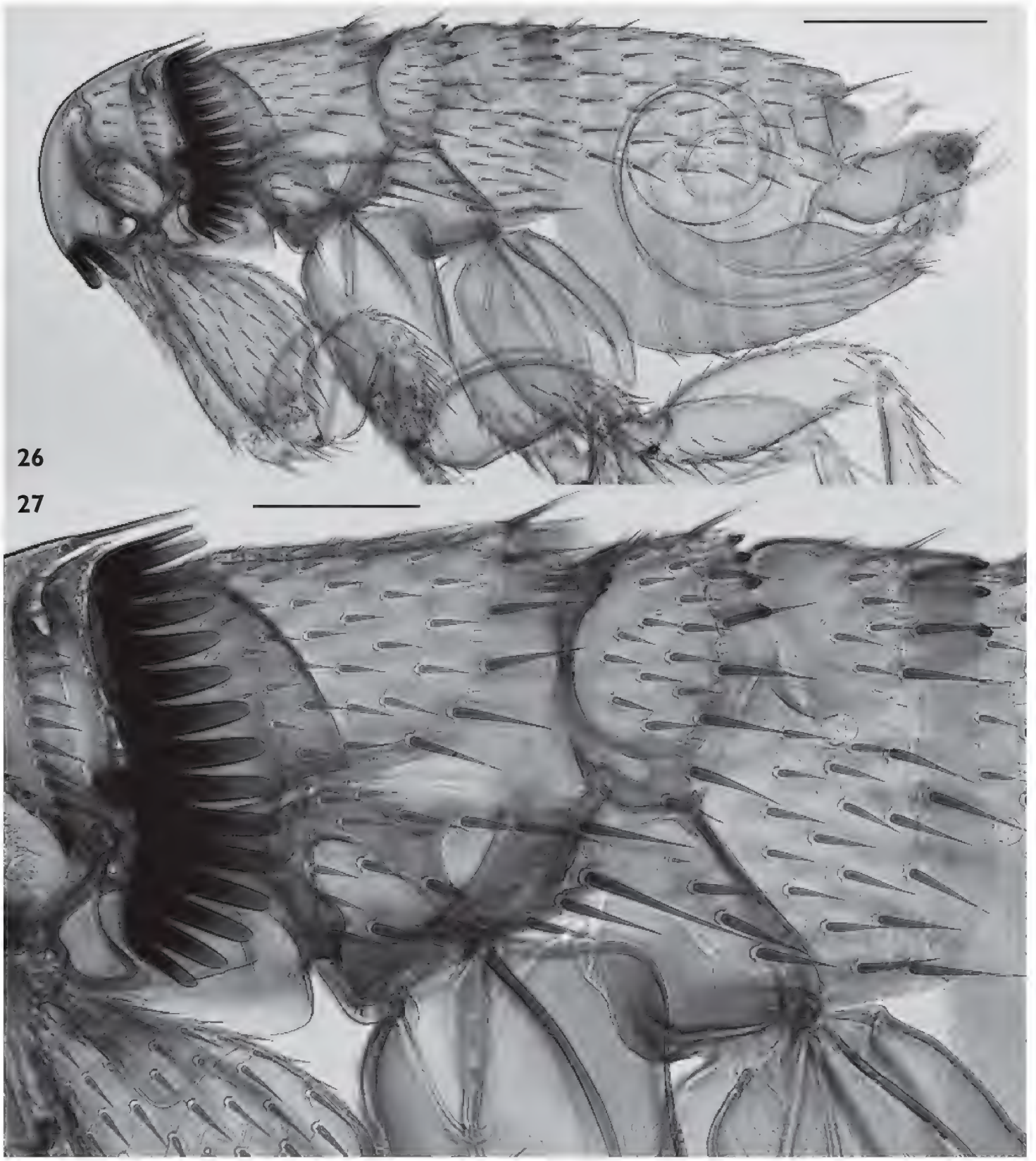


Figure 26-27. *Thaumapsylla wilsoni* n. sp., holotype ♂. 26. Whole body overview. 27. Pronotal ctenidia and thorax. Scale 200 μm

Morsby, 610 m elev., ex. *D. moluccensis*, 23 VIII 1966, 31 X 1968, 3 XI 1968, N. Wilson (slides B-84147, B-84148, B-84149). Holotype and 5 paratypes deposited in CMNH and one paratype (B-84148) in the author's collection.

Diagnosis. Female sex is unknown. Males clearly distinguished from *T. dina* Jordan, 1937 by the possession of only two preoral genal spines. Further separable from males of *T. longiforceps* Traub and *T. breviceps* Rothschild by the shape of the crochet, distal arm of S-IX, and aedeagus. Further details include a greatly expanded prosternosome with ventrad quadrate lobes, a broad marginal band lacking trans-

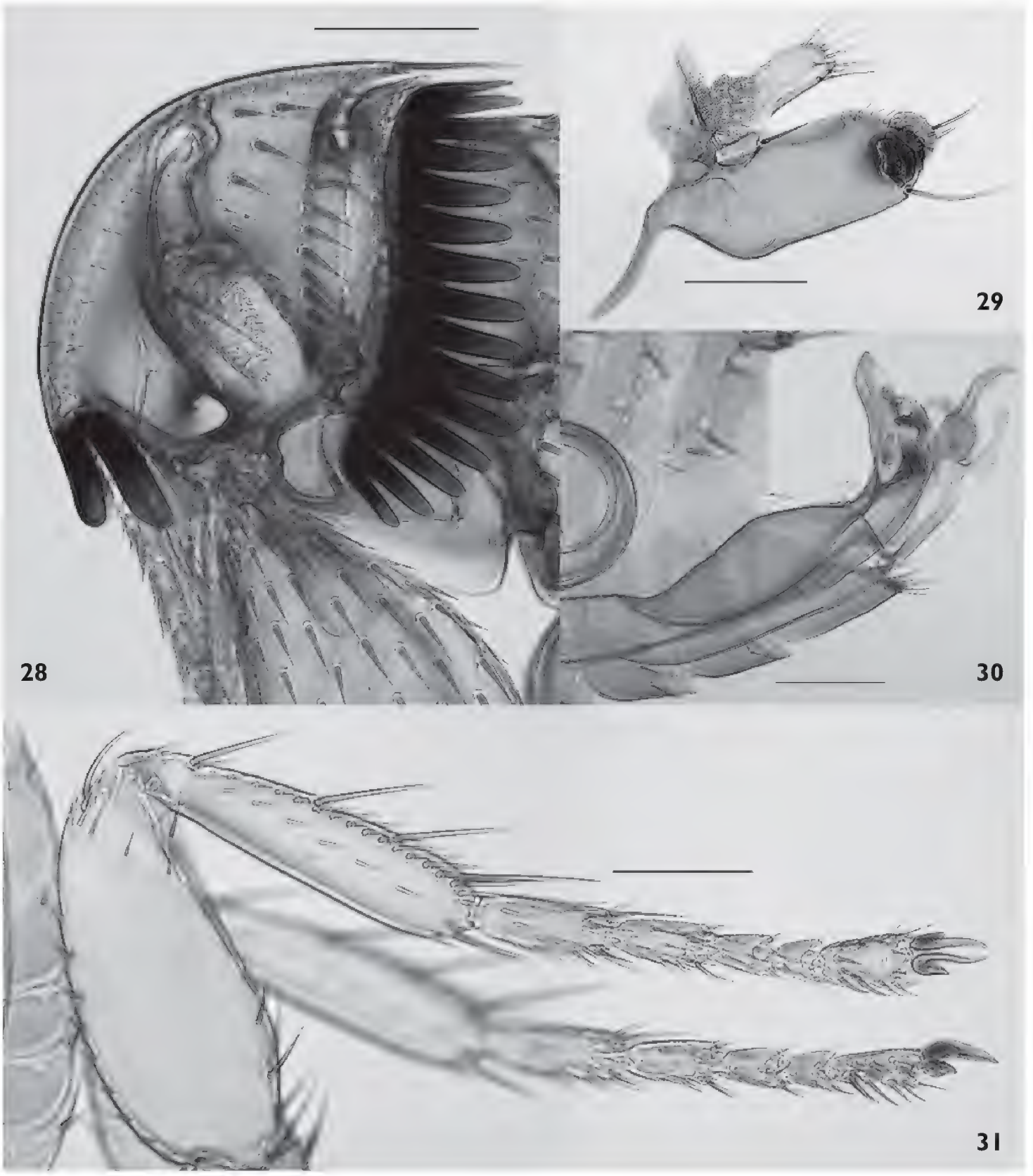


Figure 28-31. *Thaumapsylla wilsoni* n. sp. 28. Head and pronotum, holotype ♂. 29. Ninth tergite, paratype ♂ (B-84148). 30. Aedeagus, distal arm of ninth sternite, and eighth sternite, paratype male (B84148). 31. Hind legs, paratype ♂ (B-87002). Scale = 200 µm

verse striae, and lack of a distinct false comb on upper third of metatibia. Both choices in the second couplet of the key in Hopkins and Rothschild (1956:190) become problematic.

Description. Head (Figs. 26, 28). Frons and occiput gently arched separated by antennal groove almost contiguous with dorsal antennal fossa. Thin incrassation with sparse canaliculi along entire margin. Six fine setae (with 4-5 minute setae interspersed between them) parallel to margin of frons; with zone of minute coniform receptors

between frons and these setae. Three minute setae parallel with ventor of antennal fossa anterior to vestigial lightly pigmented eye. Very large ocular bristle at margin of antennal fossa extending over clavus. Genal lobe sinuate at apex; two preoral darkly pigmented spatulate genal ctenidia present; anterior slightly shorter than posterior. Two placoids along margin of frons, two along margin of occiput, and one ventral to the latter two. Four short spiniform setae at dorsal margin of antennal fossa. Two rows of large spiniform setae (1, 3), group of three smaller setae ventrad, and many fine setae anterior to those in postantennal area. Thirteen large spiniform setae at posterior margin of head; dorsomedial posterior margin of head with single long seta borne on projection extended over pronotum. Maxilla sharp at apex. Labial palpus six segments extending to 2/3 of forecoxa; segments 3-5 one third length of other segments. Antennal fossa partially covered by genal lobe. Scape with 3 apical setae; pedicel with one or two minute setae; clavus with single stubby seta on each dorsal flabellate segment. Antenna confined to antennal fossa. **Thorax** (Figs. 26-28). Pronotum ctenidia of 16-17 spatulate spines per side; spines shorter dorsally than ventrally. Ctenidia extended onto prosternosome and arching forward. Single row of six minute setae at base of pronotal ctenidia; all dorsal to robust first link plate. Prosternosome with two lobes forming an unusual quadrate ventral extension. The nature of all setae of meso- and metathorax and abdomen are spiniform and darkly pigmented. Many setae on mesothorax and mesopleuron. Noteworthy is horizontal row on ventral mesopleuron that resembles false comb. Mesopleural rod massive and bifurcate. Second link plate conspicuous. Metanotum adorned with marginal row of seven long spiniform setae; anterior group of 13-14 shorter spiniform setae. Metanotal margin with four short, blunt, black spinelets. Lateral metanotal area without setae; heavily sclerotized margins. One small and three large spiniform setae on metepisternum; meso- and metasternites reduced to heavy sclerotizations. Pleural ridge slender; pleural arch absent. Furca thread-like. Metepimeron with group of 18 spiniform setae; round spiracular fossa larger than those of abdomen. **Legs** (Fig. 31). Fore coxa robust, expanded on caudal margin with noticeably large seta; numerous lateral spiniform setae. Setae on meso- and metacoxa limited to the apical third. Two robust setae at each femoral-tibial joint; lateral smaller of two. To large setae dorsal to each femoral pit. Five dorsal notches on dorsal margin of each tibia; false combs on each. False comb of metatibia less conspicuous on dorsal third of metatibia. Fifth tarsal segments with five lateral plantar bristles; first pair shifted onto plantar surface between second pair. Two preapical spiniform plantar bristles; two thin preapical plantar hairs; three setae on pulvillus. **Unmodified Abdominal Segments** (Fig. 26). Tergum I with three marginal spinelets; main row of 4 setae and anterior group of 7-8 setae. Tergites II-VI with seven setae in main row; T-II-IV with anterior rows of 4, 3, 2 setae, respectively. Four setae on T-VII. One large antesensilial bristle, lateral small and mesal reduced to minute seta; all borne on tubercle. One seta below lever of round spiracles on all terga. Setae on S-II-VII (1, 1, 2, 1, 2, 2). Sensilium with 16 pits. Pencil-like paired proctigers arise from base of sensilial plate; each bearing terminal tuft of long setae. **Modified Abdominal Segments**. Tergum VIII with two lateral setae; ventroapical margin extends to upper margin of S-VIII. Sternum VIII

with truncate lobe; lower portion bearing row of four marginal setae and one minute seta anterior to main row. Length of basimere twice width, with dorsal fringe of fine setae and two long acetabular bristles. Telomere spherical with two large apical setae. Manubrium knife-like and directed downward. Dorsal arm of S-IX with single long seta on ventral lobe (Fig.30). Proximal arm of S-IX short; fused with ventral portion of aedeagal apodeme. Apodemal rod long, forming one complete revolution. **Aedeagus** (Fig. 30). Aedeagal apodeme expanded dorsad and sharp at apex; apical appendage nearly as long as apodeme. Penis rods forming coil of two revolutions. Median dorsal lobe narrow, extended well beyond sclerotized inner tube. Sclerotized inner tube short with thick dorsal spur. Crescent sclerite thickened at anterior. Crochet long, extended to sharp pointed apex; paxillus interlocked with sinus of distal arm of S-IX.

Length (slide mounted specimens): Holotype 2.6mm, male average: 2.6mm (n = 7; range: 2489-2665 μm).

Etymology. The species is named *Thaumapsylla wilsoni* in honor of my colleague Nixon Wilson, Professor Emeritus, University of Northern Iowa, Cedar Falls, Iowa for not only collecting this new species, but also in recognition of his untiring efforts collecting ectoparasites over many years and for his contributions to our understanding of the order Siphonaptera.

Rhopalopsyllidae

Ectinorus Jordan, 1942

A comprehensive listing of the 38 known species of the South American genus *Ectinorus* was presented in Hastriter and Sage (in press). This new species represents the 39th species in the genus *Ectinorus*.

Ectinorus hirsutus Hastriter, sp. n.

urn:lsid:zoobank.org:act:504801F4-E773-4B8B-99B5-A1387A59A991
(Figs. 32-40)

Type Material. Holotype, ♂; **Peru:** Yauli Province, Junin Department, 15.3 km N La Oroyo [~11°23'51"S, 75°53'10"W], 3963 m elev., ex. *Neotomys* sp., 15 VI 1964, T.B. Seifert (slide B-71617); allotype, ♀ (same data as holotype, slide B-71617); 2♂ paratypes (same data as holotype except leg. N.E Coon, slide B-71590 and D.L. Knowlton, slide B-71601); 2♂ paratypes (same data as holotype, except *Akodon* sp., 16 VI 1964, leg. D.R. Seidel, 2 slides B-71635, 1 is a dissection); and 2♂ paratypes (same data as holotype, except *Akodon* sp., 14, 16 VI 1964, leg. N.E. Coon, slide B-71580, and F.J. Meyer, slide B71629). Holotype, allotype, and 4 paratypes were deposited in CMNH and two paratypes (slides B-71635 and B-71580) were retained in the author's collection.

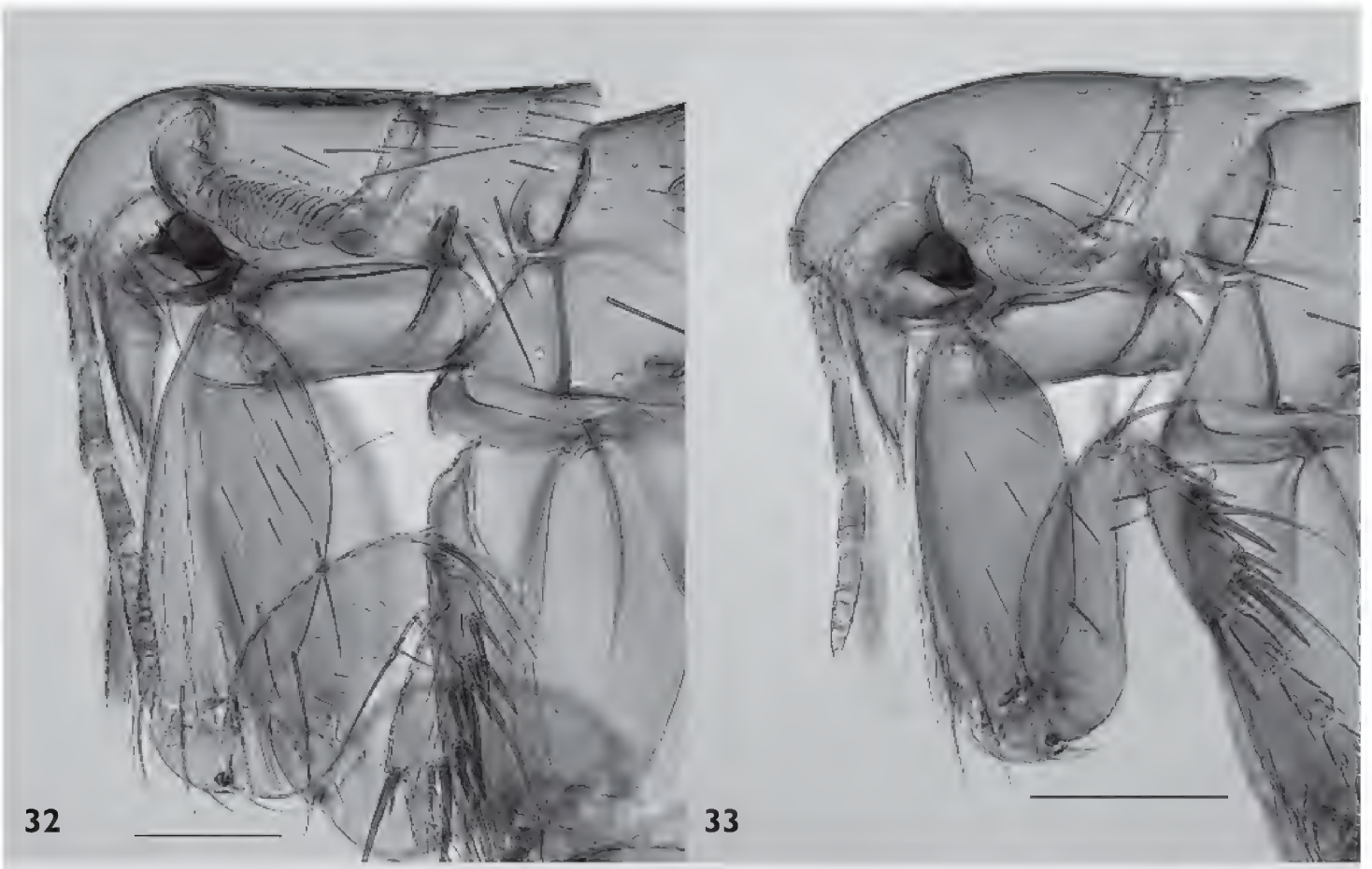


Figure 32-34. *Ectinorus hirsutus* n. sp. 32. Head and pronotum, holotype ♂. 33. Head and pronotum, allotype ♀. 34. Aedeagus, holotype ♂. Scale = 200 μm

Diagnosis. Males distinguished from all members of the subgenus *Ectinorus* that possess a *processus basimeris ventralis* by a combination of the following characters: 1) apical spinelets present on T-I, 2) the *processus basimeris ventralis* is apical and not ventrally affixed to margin of basimere, 3) the crochet is spoon-shaped, and 4) S-VIII possesses an accessory lobe bearing setae that extends beyond ventral apex of caudal margin of S-VIII. Most closely resembles *E. ineptus* Johnson and *E. uncinatus* Beaucournu & Gallardo in these characters, although easily distinguished by the details of T-IX, S-VIII, and aedeagus. Among the 18 taxa belonging to the subgenus (*Ectinorus*), the female sex has been definitively described for only twelve species (*E. alejoi* Hastrit-

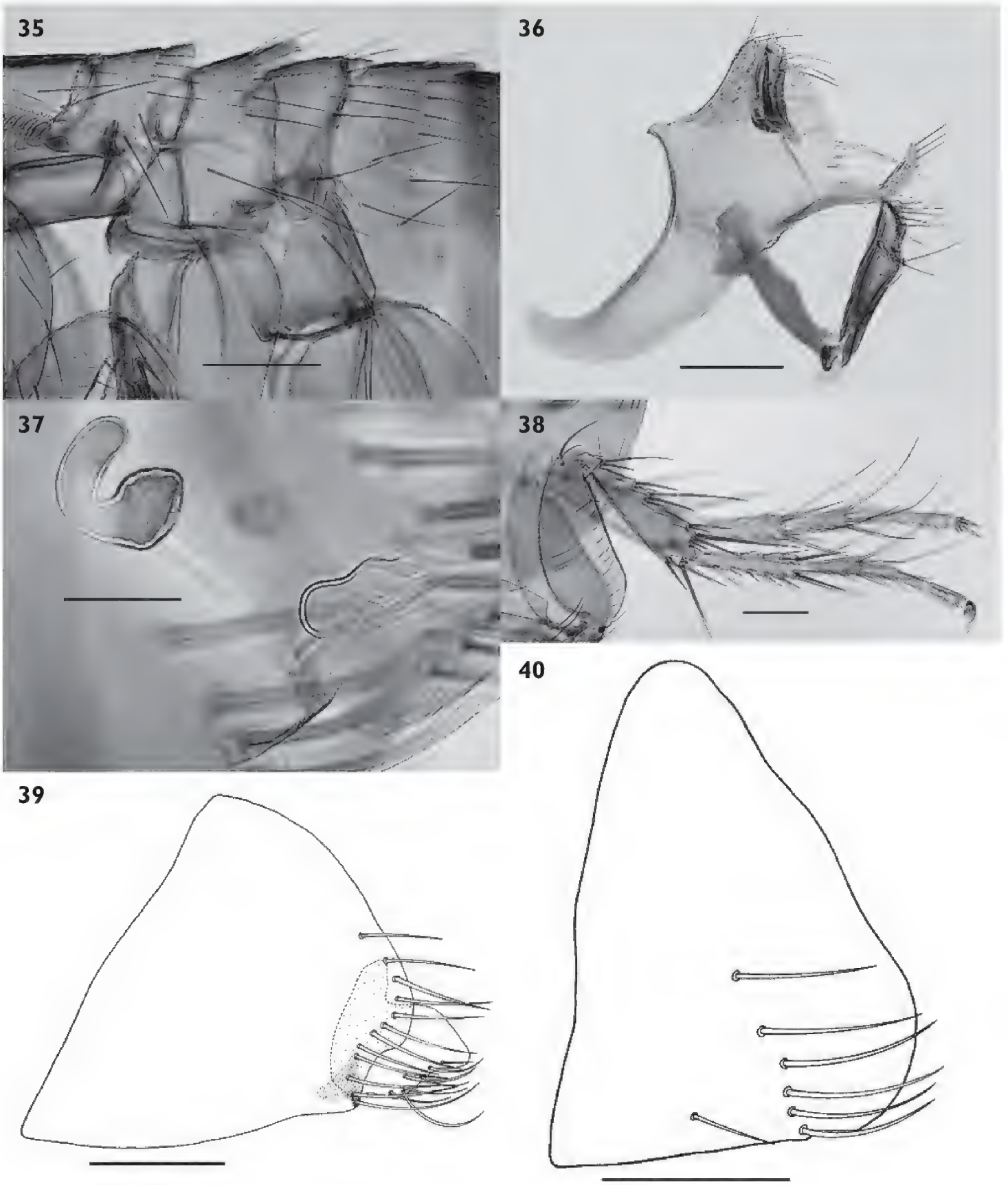


Figure 35-40. *Ectinorus hirsutus* n. sp. 35. Thorax, holotype ♂. 36. Ninth tergite and ninth sternite, paratype ♂ (B-71635). 37. Spermatheca and bursa copulatrix, allotype ♀. 38. Hind legs, holotype ♂. 39. Eighth sternite, holotype ♂. 40. Seventh sternite, allotype ♀. Scale 35-36 and 39-40 = 200 µm, 37 = 100 µm

er, *E. chilensis* Lewis, *E. cocyti* (Rothschild), *E. disjugis* Jordan, *E. gallardoi* Hastriter, *E. hecate* Johnson, *E. levipes* (Jordan & Rothschild), *E. martini* Lewis, *E. mondacai* Hastriter, *E. polymerus* Jordan, *E. trionyx* Jordan, and *E. morenoi* Hastriter). Female differs from those of *E. hecate*, *E. levipes*, *E. mondacai*, and *E. morenoi* in that the hilla is not distinctly restricted at the junction of the bulga and from *E. polymerus* and *E. trionyx*

whose bulgae are obviously longer than wide. Distinguished from the remaining five species (*E. alejoi*, *E. chilensis*, *E. cocyti*, *E. disjugis*, and *E. gallardoi*) by a combination of all the following characters: 1) hilla is much longer than length of bulga, 2) seven segments in the labial palpus (including basal palp bearing segment), 3) six setae in main row on S-VII, 4) a group of fine setae on lateral aspects of both S-II and S-III, and 5) four setae per side on S-IV-VI. Extralimital species whose female sexes are unknown include *E. lareschiae*, *E. mimacydis*, and *E. splendidus*. This new species is very closely related to *E. ineptus* Johnson, *E. uncinatus* Beaucournu and Gallardo, and *E. curvatus* Beaucournus and Gallardo. These are all geographically confined to northern Chile and the southern half of Peru. Although males are easily distinguished, the females prove to be an enigmatic complex for which identifications remain uncertain. The possession of seven segments in the labial palpus of *E. hirsutus* differs from those females tentatively assigned by Beaucournu and Gallardo (1991) to the respective "*ineptus* complex" of species (*E. ineptus*, *E. curvatus*, and *E. uncinatus*), although the number of segments in the labial palpus of this single female (allotype) may prove anomalous and not distinctive for this new species. *Ectinorus ineptus* and *E. uncinatus* display only minor differences in the male sex and *E. uncinatus* may prove to be a junior synonym of *E. ineptus*. Further material is required to assess the validity of these two species.

Description. Head (Figs. 32, 33). Frontal tubercle squared at apex; thick sclerotization behind tubercle. Fine seta dorsad and contiguous with tubercle. Two placoids along margin of frons; one placoid caudad to scape and one more posterior near occipital groove. Preanntennal area with numerous minute coniform peg-like receptors. Single seta along antennal fossa anterior to moderately pigmented eye. Ocular row with three long setae; two shorter setae (female with four). Genal process bluntly acute; with marginal row of 4-6 setae caudad and ventrad to eye, two short setae at apex of gena. Lateral and anterior tentorial arms fused and connecting eye with margin of gena. Postantennal area with three rows of setae (1, 1, 6). Dorsal margin of antennal fossa with row of 22 minute spiniform setulae (female with 5-6). Seven setae confined to apical margin of scape; barely extended to apex of pedicel. Pedicel without setae; apical segments of clavus extended onto prosternosome. Maxilla acutely sharp at apex. Labial palpus of seven segments; extends to apex of fore coxa. **Thorax** (Figs. 32, 33, 35). Pronotum with main row and incomplete anterior row of setae. First link plate affixed to shallow notch on prosternosome (link plate vestigial in female). Mesonotum with 14 pseudosetae (female with 12); two complete rows of setae with scattered anterior setae. Mesepisternum with one seta; mesepimeron with four setae. Metanotum with main row and anterior row of setae; caudal margin hyaline. Lateral metanotal area with one short and two long setae. Metepisternum with single long seta; pleural arch present. Metepimeron with two vertical rows, two setae each; spiracle mushroom shaped (asymmetrical). **Legs** (Fig. 38). Procoxa with 25-27 lateral setae (including marginals) (female with 18-20). Lateral sulcus of mesocoxa vestigial at apex. Anterior margin of meso- and metacoxa with setae on anterior margin. Profemur with 14-15 small lateral (female with 7-8); 3-4 small mesal seta (female with 2). Femoral-tibial guard setae two on all segments; equal size on fore femur, lateral smaller of two

on meso- and metafemora. Margin of fore, mid and hind tibiae with 6, 7, 7 dorsal notches, respectively. Number of setae in respective dorsal notches: fore tibia (beginning with proximal notch) (2, 2, 2, 3, 2 3) (female with 1, 2, 2, 3, 2, 3), mid tibia (1, 2, 1, 2, 3, 2, 3), hind tibia (2, 2, 1, 2, 3, 2, 4). Lateral setae of meso- and metatibia, respectively (5, 6). Two long slender setae on hind tarsi I extended to apex of tarsus II; one seta extended to apex tarsus III. Hind tarsus III with three long slender setae extended well onto distotarsomere. Distotarsomeres each with four pair lateral plantar bristles, two spiniform preapical plantar bristles; in addition to preapical lateral hairs. Numerous fine setae on plantar surfaces of all distotarsomeres. Female lacking long slender setae. **Unmodified Abdominal Segments**. Tergum I with six marginal spinelets (female with 4); two rows setae (5, 6) (female with 4, 5). Tergites II-VII with 7-8 setae in main row; ventral most of each row at level with small round spiracles (female with 1-2 setae below level of spiracles). Sternum II with single ventral seta and two small lateral setae (female with 4-5 lateral setae); S-III with single small lateral seta (female with 3-4 lateral setae), S-III-VII with three ventral setae (female with S-III-VI with 3, 3, 4, and 4 ventral setae). **Modified Abdominal Segments, Male** (Figs. 36, 39). Single antesensilial bristles on projection. Sensilium with 18 sensilial pits. Tergum VIII vestigial. Tergum IX massive relative to abdomen; manubrium hooked upward at apex. Caudal margin fringed with many long setae; *processus basimeris ventralis* arising from apical margin into large lobe bearing caudal fringe of stout setae. Telomere parallel sided, oblique at apex. Acetabulum set well back from caudal margin of basimere. Sternum VIII with caudal lobe subtended by ventral sinus; adorned along margin with 11-12 long setae. At apex of S-VIII, subventral lobe adorned with multiple curved setae. Proximal arm of S-IX with expanded apex attached to inner aspect of junction of basimere and manubrium. Distal arm of S-IX with lobe on caudal margin bearing 2-3 long setae; numerous fine lateral setae, and 6-7 long setae along apicocaudal margin. Apex of S-IX with caudally directed tooth-like appendage. **Aedeagus** (Fig. 34). Median dorsal lobe acutely pointed at apex. Apico-median sclerite with caudal sinus and ventro-apical hook. Crochet spoon-shaped; heavily sclerotized at ventral margin. Sclerotized inner tube widening towards apex with oblique line ending with small ventral spur (appears as artifact, but is present on all specimens examined); slight swelling at base. Anterior portion of crescent sclerite thickened. Girdle ventrally expanded; truncate at ventral apex. Penis rod single, extending to apex of aedeagal apodeme (penis rod extended well beyond aedeagal apodeme in illustration because it was pulled out during dissection). Aedeagal apodeme broad; round at apex. Small proximal spur present. **Modified Abdominal Segments, Female** (Fig. 37, 40). Tergum VIII especially long on dorsal margin; five small dorsal setae, 5-8 long lateral setae. Caudal lobe with 11-12 long marginal setae; 5-8 small sharp setae at mesal surface near margin. Spiracle VIII vermiform. Sensilial plate with 18 sensilial pits per side. Sternum VII with row of six long setae; caudal margin with round ventral lobe subtended by small sinus. Sternum VIII bluntly rounded; longitudinal sculpturing present. Dorsal anal lobe with scattered setae; anal stylet twice as long as width. Anal stylet placed at ventral margin; dorsal anal lobe bearing one long apical seta; two short setae ventrad to base of long seta. Ventral

anal lobe with scattered setae on apical half; ventral margin sclerotized. Spermatheca with hilla longer than bulga. Bulga obliquely flattened at subventral margin of cribriform area. Bursa copulatrix sclerotized, arching caudad; perula slightly globular without sclerotization. *Fibula vaginalis* long, sclerotized, and distinct.

Length (slide mounted specimens): Holotype 1.9mm, male average: 1.7mm (n = 6; range: 1534-1970 µm); allotype 2.3mm

Etymology. The ninth tergite and the eighth and ninth sternites of the male are adorned with rows of long setae producing an appearance of "hairy" or "shaggy", thus *hirsutus* (L.)

Remarks. *Neotomys* appears to be the preferred host of *E. hirsutus*. Only *Neotomys* was recorded on the slides and on the "B" number records of Robert Traub. Voucher specimens could not be traced to validate the field identifications; however, the type locality of *E. hirsutus* is sympatric with that of *Neotomys ebriosus* Thomas, the only species in the genus. Occurring together with this new species on *N. ebriosus* were the two specimens (male and female) of *Sphinctopsylla inca* (Rothschild) and a single female *Tetrapsyllus bleptus* (Jordan & Rothschild) identified by Robert Traub.

Acknowledgments

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